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EXAMINER	
YIGDALL, MICHAEL J	

ART UNIT	PAPER NUMBER
2192	

DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/755,502	KHU, ARTHUR H.	
	Examiner	Art Unit	
	Michael J. Yigdall	2192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-9,16-18,20,21 and 23-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-9,16-18,20,21 and 23-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This Office action is in response to Applicant's submission filed on September 13, 2005. Claims 1, 3-9, 16-18, 20, 21 and 23-26 are pending.

Response to Arguments

2. Applicant's arguments have been fully considered but they are not persuasive.

Applicant contends that Haraguchi does not suggest converting a keyword statement to a data array reference (Applicant's remarks, page 8, last paragraph).

However, the examiner does not agree with Applicant's characterization of the reference. First, it is noted that the claim recites, "converting in the program code, each data reference in each keyword statement to a data array reference" (claim 1). Second, Applicant acknowledges that Haraguchi teaches merging multiple program loops with different array references into a single program loop (Applicant's remarks, page 8, last paragraph). Indeed, Haraguchi expressly discloses that "the array descriptions which can be executed by the same loop ... are gathered and by doing so, the specific portion of the array descriptions can be converted so that it can be executed by the same loop" (column 1, line 64 to column 2, line 3). In other words, the different array references in the multiple program loops are gathered and converted to array references in the single program loop. Applicant contends that the array references stay the same and thus there is no converting of a keyword statement to a data array reference (Applicant's remarks, page 8, last paragraph). However, the plain language of the claim does not exclude converting a data array reference in one loop to a data array reference in another loop. Moreover, the data array references do not necessarily stay the same, as Haraguchi illustrates (see, for example,

column 2, lines 24-42, which shows the original data array references, and column 7, lines 42-59, which shows the converted data array references).

Applicant contends that the alleged motivation for modifying Cooper with the teachings of Haraguchi is improper and does not support a *prima facie* case of obviousness (Applicant's remarks, page 9, first paragraph).

On the contrary, one of ordinary skill in the art would have been motivated to supplement the method of Cooper with the teachings of Haraguchi, as presented in the previous Office action. Applicant recognizes that Cooper and Haraguchi teach separate approaches to optimizing code (Applicant's remarks, page 9, second paragraph). Specifically, Cooper teaches reducing the size of the code (see, for example, page 139, the abstract), and Haraguchi teaches merging loops in the code (see, for example, step S5 in FIG. 3 and column 9, lines 54-60). The loop merge not only optimizes execution performance, but also eliminates repeated loop control statements to reduce the size of the code (see, for example, column 1, line 59 to column 2, line 23). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supplement the method of Cooper with the teachings of Haraguchi so as to further reduce the size of the code and thus further optimize execution performance. Cooper notes that "for applications in which code space is a critical resource, the compiler should employ both robust classical optimization and code compression" (page 146, first column, last three lines; emphasis added), suggesting a reasonable likelihood of success.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 3-9, 16-18, 20, 21 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Enhanced Code Compression for Embedded RISC Processors" by Cooper et al. (art of record, "Cooper") in view of U.S. Pat. No. 6,074,433 to Haraguchi et al. (art of record, "Haraguchi") in view of U.S. Pat. No. 5,606,698 to Powell (art of record, "Powell").

With respect to claim 1 (previously presented), Cooper discloses a method of optimizing computer program code where the computer program code includes a plurality of statements (see, for example, page 139, the abstract), the method comprising the steps of:

(a) identifying a keyword statement, wherein the keyword statement includes a keyword and a data reference (see, for example, page 140, section 2.1, which shows identifying an instruction or keyword statement that includes both an opcode or keyword and register references or data references);

(b) sequentially locating each keyword statement in the program code (see, for example, page 140, section 2.1, which shows locating each equivalent instruction or keyword statement in the program code).

Although Cooper discloses converting each keyword statement and its data references to an indexed entry in a table or data array (see, for example, page 140, section 2.1), Cooper does not expressly disclose the step of:

(c) converting in the program code, each data reference in each keyword statement to a data array reference.

However, Haraguchi discloses identifying data references in program code (see, for example, steps S1 and S3 in FIG. 3, and column 9, lines 29-32 and 44-47) and performing a loop merge (see, for example, step S5 in FIG. 3 and column 9, lines 54-60). A loop merge comprises converting the data references in the program code to data array references in a new loop so as to eliminate repeated loop control statements and optimize execution performance (see, for example, column 1, line 59 to column 2, line 23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to supplement the method of Cooper to convert, in the program code, each data reference in each keyword statement to a data array reference, such as taught by Haraguchi, so as to reduce the size of the program and optimize execution performance.

Cooper in view of Haraguchi further discloses:

(d) searching the program code for the keyword statement after the conversion of each data reference to a data array reference (see, for example, page 140, section 2.1, which shows searching the program code for the keyword statement after the conversion);

(e) determining if the keyword statement begins a repeating pattern of statements in the program code (see, for example, page 140, section 2, which shows finding repeated patterns of statements in the program code).

Although Cooper discloses replacing a repeated pattern of statements with a jump instruction or a procedure call equivalent to the repeated pattern (see, for example, page 141, section 3, and Figures 3 and 4), and although such a procedure call would operate as a program loop when consecutive repeated patterns are replaced and executed in succession, wherein the number of inserted call and return instructions (see, for example, page 141, section 3) would control the number of loop iterations, Cooper does not expressly disclose the step of:

(f) replacing the repeating pattern of statements with a program loop equivalent to the repeating pattern of statements.

However, Powell discloses replacing successive invocations of identical system functions with loop constructs (see, for example, column 5, lines 55-62), so as to minimize the amount of necessary program code, thereby reducing the amount of memory necessary to store the program code (see, for example, column 2, lines 45-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to supplement the method of Cooper to replace the repeated pattern of statements with an equivalent program loop, such as taught by Powell, so as to reduce the size of the program and the amount of memory needed to store it.

With respect to claim 3 (previously presented), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the converting includes assigning an array index value to the data array reference where each located keyword statement is assigned a next sequential value of the array index value (see, for example, Haraguchi, column 1, line 59 to column 2, line 23, which shows assigning an index value I to the

data array references A and B where each statement is assigned the next sequential value from 1 to 10).

With respect to claim 4 (currently amended), the rejection of claim 3 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the determining step further includes:

(a) comparing data array references of two converted keyword statements from the program code (see, for example, Haraguchi, column 11, lines 37-45, which shows comparing data array references based on the dimension or size and order of the index values); and

(b) determining if the array index values from the data array references match in size and sequential order (see, for example, Haraguchi, column 13, lines 10-23, which shows determining if the index values are common among the data array references).

With respect to claim 5 (currently amended), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the determining step includes:

(a) determining a first pattern of statements in the program code beginning with a first converted keyword statement and ending with a statement preceding a second converted keyword statement that sequentially appears in the program code after the first converted keyword statement;

(b) determining a second pattern of statements in the program code beginning with the second converted keyword statement and ending with a statement preceding a third converted

keyword statement that sequentially appears in the program code after the second converted keyword statement; and

(c) comparing the first pattern of statements to the second pattern of statements; and

(d) setting the first pattern of statements as a repeating pattern if the first and second pattern of statements substantially match.

Cooper discloses the steps above in terms of finding repeated patterns in the program code, which are delineated by first, second, third, etc. instructions or keyword statements, by comparing sets of instructions and determining whether the sets are equivalent (see, for example, page 140, sections 2 and 2.1, and see, for example, Figure 2, which show two matching patterns of statements or a repeated pattern of statements in the program code).

With respect to claim 6 (original), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the replacing step includes:

(a) generating loop code for executing a loop within the source code at location of the repeating pattern of statements (see, for example, Powell, column 5, lines 55-62, which shows generating loop code for the repeated pattern of statements);

(b) inserting one instance of the repeating pattern of statements within the loop code (see, for example, Powell, column 7, lines 33-38, which shows inserting an instance of the repeated pattern in the loop code); and

(c) defining the loop code iterate a number of times equal to a number of instances of the repeating pattern (see, for example, Powell, column 6, lines 11-17, which shows defining the loop code to iterate the same number of times the repeated pattern is invoked).

With respect to claim 7 (original), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the keyword statement is identified from a predetermined keyword statement (see, for example, page 140, section 2.1, which shows that the instruction or keyword statement is identified based on the opcode predetermined from the instruction set).

With respect to claim 8 (original), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses the limitation wherein the keyword statement is identified from a selection made by a user (see, for example, page 140, section 2.1, which shows that the instruction or keyword statement is identified based on the constants selected by the user).

With respect to claim 9 (original), the rejection of claim 1 is incorporated, and Cooper in view of Haraguchi in view of Powell further discloses identifying a plurality of keyword statements and repeating the method for optimizing for each of the plurality keyword statements (see, for example, page 140, sections 2 and 2.1, which shows identifying each instruction or keyword statement and finding all of the repeats in the program).

With respect to claim 16 (previously presented) and claims 17, 18 and 20 (original), the limitations recited in the claims are analogous to those of claims 1, 5 and 6 (see the rejections of claims 1, 5 and 6 above).

With respect to claims 21, 23, 24 and 25 (previously presented), the limitations recited in the claims are analogous to those of claims 1, 3, 5 and 6 (see the rejections of claims 1, 3, 5 and 6 above).

With respect to claim 26 (previously presented), the limitations recited in the claim are analogous to those of claims 1, 3, 5 and 6 (see the rejections of claims 1, 3, 5 and 6 above).

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Yigdall whose telephone number is (571) 272-3707. The examiner can normally be reached on Monday through Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MY

Michael J. Yigdall
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SUPERVISORY PATENT EXAMINER